Student Intention Behavior to use Smart Campus in Egyptian University

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Abstract:

This study aims to understand the perspective of Egyptian students towards a smart university campus and applying IOT techniques. Quantitative research examines students' intention to learn in a smart campus that applies Internet of Things (IOT).An online survey was designed to collect the desired data, where the sample size is321.The proposed research model was developed based on the combination of Unified Theories of Acceptance and Use of Technology (UTAUT) variables. This includes Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Condition and UTAUT2 variables, which are Hedonic Motivation, Price Value and Habit on conducted analysis. The results show that Social influence, Hedonic Motivation and Price value have a high correlation to students' intention to use a smart campus. On the other hand, Performance Expectancy, Effort Expectancy, Facilitating conditions and Habits have high correlation significance on students' intention to use university smart campus.

Keywords: UTAUT, Smart Campus, Educational, university, IOT, Egypt.

1. Introduction

Digital transformation affected different fields after the Covid-19 lockdown. Internet of things and Machine Learning are revolutionizing the Internet. Physical devices are using the internet to activate and interact with societies and individuals. IoT is defined as a network of intelligent network of different physical devices or objects that contain advanced technology and are interconnected (Airehrour, et al., 2016;).

Multiple IOT applications were implemented across both the private and public sectors, including supply chain management, manufacturing, and healthcare and traffic management in cities (Carcary et al., 2018).

IOT has many barriers preventing its implementation. Organizations are less inclined to use IOT technologies, as it requires the adoption of an ensemble of hardware, software and networking. This requires a variety of protocols, technologies, devices, social, behaviors, economic matters and managerial issues associated with IoT (Carcary et al., 2018). However, IoT helps humans to connect to with each other. When applying IOT on a campus, it will create an intelligent system.

Assante et al. (2018) focuses on the importance of IoT for small and medium-sized enterprises(SMEs) in Europe to survive and be sustainable in comparison to non-European enterprises.

Many researchers discussed the importance of IoT in smart cities(Chagnon et al., 2021; Valks et al., 2020; Adenle et al., 2021).IoT allows for smart traffic management, environment monitoring, smart parking, smart irrigation, smart lighting, smart waste management. Other researchers discussed the problems of IOT reliability such as software faults, human faults and soft errors(Abichet al., 2020; Ibrahim et al., 2020).

Smart Campus is one of the newest concepts to for IoT's application to the education field (Alhazmi et al., 2023; Martins et al., 2021). Examples for IOT applications in campus are smart classrooms, smart libraries and smart books.IOT technologies manage smart campuses through the IoT, including temperature-controlled devices, light power, security cameras and building access, simplified access control, enhanced security, classroom monitoring, notifications, automated attendance processes, integration of the IoT, open data in school books, smart boards and smart libraries to keep track of library books (Shehzad et al., 2020; Alalade et al., 2019).

Unified Theories of Acceptance and Use of Technology (UTAUT) introduced by (Venkatesh et al., 2003) is a model assess the users' acceptance of technology used and user mental perceptions.

The paper examines the student perception to study in a smart campus. Factors are extracted from previous researchers examined using a structured equation modeling. A research model was created based on the variables selected from previous research, the model would help educational institutions to be able to adapt IOT technologies and managing the acceptance level of the university students.

This paper contains five major sections. Section one provides an introduction about the research. Section two briefly describes the literature review that includes IOT, Smart Campus and factors affecting the students' perception to study in a smart campus in university. In section three, a description of the proposed research model and research hypotheses are the focus of this section. The research methodology includes data collection and sample size and survey. Section four provides the statistical analysis consists of descriptive analysis, reliability test, exploratory factor analysis and confirmatory factor analysis. Section five displays discussion of the results. Lastly, conclusion, and implications of this research, limitation and future work are presented in section six.

2. Literature Review

The new trends of technology development guided by artificial intelligence(AI), the IoT and robotics transforms the traditional-based processes to digitalized one(Alhazmi et al., 2023). IOT is used to enhance all services available to the

customers including education, construction, waste management, pollution, energy consumption (Jabbar et al., 2021;Adenle et al., 2021).IoT is used to connect people and devices. Furthermore, it can implement the data and the processes. The information processed for IOT can be valuable for decision making in the management levels (Adam et al., 2023).

Chweya and Ibrahim (2021) use IoT facilitates in smart classrooms and smart campus technologies that include the following activities: monitoring of attendance, heating and lighting, smart whiteboards and smart books.

Researchers (Al-Emran, et al., 2020; Martins et al., 2021) monitored students sleeping behaviors and social behaviors in classes using IOT technologies.

IOT can reduce the costs of energy and rubbish management when used in smart cities (Verma et al., 2021). Smart cities are known for following intelligent behavior: biometric entry, bus tracking, parking sensors, wireless door locks, smart ticketing situational awareness, sensor-driven decision-making and instant support (He et al., 2021).

Mircea et al.(2021) proved that IOT enhanced the student, and faculty collaboration through real-time interactions, shared access to materials, shared screens, online repository, project collaborations, connected campuses, as well as data sharing (Riekki and Mamm el al., 2021;Ionescu-Feleaga,et al., 2021).

Different researchers concluded that IOT can improve the students' performance level in the study (Mircea et al., 2021;Al-Emran, et al., 2020;Martins et al., 2021). IOT can improve learning experiences, provide VR learning and animation, enhance instant communication with teachers, design personalized learning, flexible learning and develop education for special human needs.

Kumar (2021) concluded that IOT could reduce barriers to education such as equity, location, social human integrity and economies.

He et al.(2021) investigated the use of IOT in China in within the educational paradigm, the results proved that IOT technology could enhance the security and educational management issues.

According to (Al-Emran, et al., 2020), the IoT is used in Oman universities, it can be used to develop students 'participation, motivation, attention, examination and feedback. Results show that teachers and students' collaboration was enhanced and the data extracted from IOT is used to monitor and track activities.

In Romania, Ionescu-Feleaga et al. (2021) examined student acceptance to apply IoT technologies. University students in from the perspective of economic studies in Romania. Results show that they are motivated to use IOT technologies in education.

Mohammadian (2019) solved education problems such as pertaining to the curriculum, cultural challenges, human resources, distance learning and enhance the reliability ofthe examination process. He used interactive textbooks, 3D positioning technologies and intelligent camera vision.

Silva et al. (2021), appraised the educational management decision-making process. IoT has the potential to shift the educational system's design to be more responsive to students' needs. Mahmood et al. (2019) proposed a framework for measuring students' behavior and attentiveness by observing facial expressions.

. UTAUT has four constructs influencing the behavioral intention in using technology: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition (Venkatesh et al.,2003).

Venkatesh et al. (2012) enhanced the previous model by adding Hedonic Motivation, Price Value, and Habit, known as the UTAUT2 model.UTAUT2 variables have a significant impact on behavioral intention to adopt a particular technology (Shaikh H. et al.,2019; Pérez et al.,2021; Mehta et al.,2019; Carcary et al., 2018).

In the same way, Pérez et al. (2021) examine the attitudes and perceptions of instructors regarding the change in the smart Learning space (SLS) environment in Catalonia (Spain).The results show that instructors are less perceptive regarding the

adoption the SLS and this identifies the need for educational reflection about change.

Mehta et al. (2019) identify the individual level of E-Learning readiness using UTAUT2 and they predicted the behavioral Intention using quantitative Survey in Gambia and the United Kingdom.

Shaikh H. et al. (2019) tests the acceptance of IoT in HEIs using UTAUT2 in Pakistan and the results had shown a high acceptance to the usage of IoT in E-Learning.

This study investigates the factors affecting students' perception towards smart campus in Egyptian universities. Different variables are used, including Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition, Hedonic Motivation, Price Value and Habit.

3. Research Methodology

The paper aims to understand student behavior towards using smart university campuses and applying IOT techniques. The researcher used Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition, Hedonic Motivation, Price Value and Habit selected from the literature.

This research aims to significantly identify the factors (and their interdependence relationships) that determine the behavior of students towards smart campus. The researcher conducted an online survey among the enrolled students at the Arab Academy for science and technology and Maritime Transport in the college

of Management and Technology. 321 students filled the survey. The questionnaire involves all study variables and three demographic information. Twenty-seven questions are placed in the questionnaire, and the Likert-type five level scales are employed. The options for each question using points 1 to 5 to represent extremely disagree, disagree, neutral, agree, and extremely agree, respectively as shown in Table 1.

Table1:Respondents'Profile

Attribute	Category	Frequency	Percent
Department	BIS	90	28.3%
	Marketing	110	34.26%
	Accounting	70	21.80%
	Finance	51	15.88%
Gender	Male	127	39.56%
	Female	194	60.43%
Academic year	Year 1	30	9.34%
	Year 2	40	12.46%
	Year 3	152	47.35%
	Year 4	99	30.84%
Total	**Total**	**321**	

The second part of the questionnaire contains five sets of questions related to UTAUT variables (Venkatesh et al., 2003).Eight constructs influencing the behavioural intention in using technology: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Condition.UTUAT2 that uses

the following variables: Hedonic motivation, price value and habit (Venkatesh et al., 2012), which are represented on Table 2.

Table2:Research Model Factors

Attribute	Definition
Performance Expectancy	It is defined as individual's beliefthat smart campus can enhance the learning process (Shaikh H. et al.,2019; Pérez et al.,2021;Mehta et al., 2019).
Effort Expectancy	The ease of using smart campus that helps to minimize travel and movement effort (Shaikh H. et al.,2019; Pérez et al.,2021;Mehta et al., 2019).
Social Influence	The degree to which people around user perceive that smart campus is significant(Shaikh H. et al.,2019; Pérez et al.,2021;Mehta et al., 2019).
Facilitating Condition	To what extent smart campus can facilitate the learning process (Shaikh H. et al.,2019; Pérez et al., 2021;Mehta et al., 2019; Baabdullah, 2018).
Hedonic Motivation	HM translate user's happiness and enjoyment when using smart campus in the learning process (Shaikh H. et al.,2019; Pérez et al., 2021;Mehta et al., 2019; Baabdullah, 2018).
Price Value	The cost and the price to apply smart campus in the learning process (Shaikh H. et al.,2019; Pérez et al., 2021;Mehta et al., 2019; Baabdullah, 2018;Chopdar,et al., 2018).
Habit	The process in which the smart campus functions became an ordinary action done by students (Shaikh H. et al.,2019; Pérez et al., 2021;Mehta et al., 2019).

The second part of the questionnaire contains eight sets of questions related to UTAUT variables and UTAUT 2 proposed by (Venkatesh et al., 2003; Venkatesh et al.,2012) as shown in Table 3.

Table3:Research Model Factors and the items

Factor	Encoding	Statements
Performance Expectancy (PE) (Mostafa and Essawi,2022)	PE1	I believe that using a smart campus is useful
	PE2	I believe that the a smart campus provide faster service
	PE3	I think a smart campus is useful to make it faster and easier
	PE4	The interaction with a smart campus is clear and understandable
Effort Expectancy (EE) (Mostafa and Essawi,2022)	EE1	I feel that I will be an active member of the society smart campus
	EE2	I feel happy when I use a smart campus in learning
	EE3	I will use all the features of a smart campus
	EE4	I will miss a smart campus if for any reason I cannot use it
Social Influence (SI) (Mostafa and Essawi,2022)	SI1	Most of my friends will use a smart campus
	SI2	Most of my friends motivate me to use smart campus in learning
	SI3	My family will use smart campus in learning
	SI4	My family members motivate me to use a smart campus in learning
Facilitating Condition(FC) (Mostafa and Essawi,2022)	FC1	I have the resources necessary to use a smart campus in learning.
	FC2	I have the knowledge necessary to use a smart campus in learning.
	FC3	Smart campuses are compatible with other technologies I use.
	FC4	I can get help from others when I have difficulties using a smart campus in learning.
Hedonic Motivation (HM)(Mostafa and Essawi,2022)	HM1	Learning the use of a smart campus will be easy for me
	HM2	I will enjoy using a smart campus in learning
	HM3	I believe that the use of smart campus would be enjoyable process
	HM4	I believe that the use of smart campus would be a fun process

Price Value (PV) (Baabdullah, 2018; Chopdar,et al., 2018	PV1	Smart campuses are a good value for the money
	PV2	Smart campuses are reasonably priced
Habit (Baabdullah, 2018; Chopdar,et al., 2018	H1	I believe that a smart campus usage will be a habit in my life
	H2	I will use a smart campus as a regular basis
Behavioral Intention (BI) (Mostafa and Essawi,2022)	BI1	Given the opportunity, I will use a smart campus in learning
	BI2	I am willing to use a smart campus in the near future.
	BI3	I am open to use a smart campus
	BI4	I intend to use a smart campus in the future

After defining the factors and their associated elements, hypothesis are formulated to understand the relationships between factors. Table no. 4 summarizes the research hypotheses we used in the study.

Table4:Research Hypothesis

#	Hypothesis
H1-PE	Performance Expectancy has a significant effect on Behavior intention to use University smart campus
H2-EE	Effort Expectancy has a significant effect on Behavior intention to use University smart campus
H3-SI	Social Influence has a significant effect on Behavior intention to use University smart campus
H4 FC	Facility Conditions has a significant effect on Behavior intention to use University smart campus
H5 HM	Hedonic Motivation has a significant effect on Behavior intention to use University smart campus
H6-PV	Price value has a significant effect on Behavior intention to use University smart campus
H7-H	Habit has a significant effect on Behavior intention to use University smart campus

4. Statistical Analysis and Results

The research type is a quantitative one and the proposed model was constructed based on literature review. The data collection is a survey employed used an online Google form. The target population was students in university. Two statistical software, SPSS25.0 and AMOS 23.0,were used to measure the proposed model variables relationships. The following tests are following descriptive analysis, reliability test, Chi-square test and Pearson Correlation.

Reliability

Reliability test defines the consistency of the data, it is calculated, determined and by applying the test method of the Cronbach's alpha coefficient (Saunders et al., 2016).Table 5 presents the results of the reliability test. According to Cortina (1993), value of the Cronbach's alpha coefficient must be greater than 0.7.

Table5:Reliability Test

Latent Variable	Item	Factor Loading	Composite Reliability CR	Cronbach's alpha	Average Variance Extracted AVE
Performance Expectancy	PE1	0.732	0.792	0.785	0.736
	PE2	0.783			
	PE3	0.713			
	PE4	0.719			
Effort Expectancy	EE1	0.801	0.769	0.801	0.771
	EE2	0.752			
	EE3	0.821			
	EE4	0.712			
Social Influence	SI1	0.916	0.954	0.922	0.933
	SI2	0.955			
	SI3	0.936			
	SI4	0.928			
Facilitating Conditions	S1	0.821	0.866	0.813	0.852
	S2	0.892			
	S3	0.811			
	S4	0.884			
Hedonic Motivation	HM1	0.921	0.906	0.915	0.909
	HM2	0.902			
	HM3	0.903			
	HM4	0.911			
Price Value	PV1	0.981	0.955	0.971	0.984
	PV2	0.988			
Habit	H1	0.782	0.782	0.741	0.762
	H2	0.742			
Behavior intention to use University smart campus	BI1	0.817	0.831	0.837	0.834
	BI2	0.862			
	BI3	0.824			

Chi-Square Test

Chi-square tests whether the dependent and independent variables are associated and whether this association is significant (Saunders et al., 2016).Chi-square results show that all association with the independent variable BI is significant as shown in Table 6.

Table6:Chi-square Test

Association	Chi square value	Asymptotic significance	Result
PE-> BI	1.351	0.000 <0.01	Significant
EE-> BI	1.245	0.000 <0.01	Significant
SI-> BI	1.398	0.000 <0.01	Significant
FC-> BI	1.135	0.000 <0.01	Significant
HM-> BI	1.349	0.000 <0.01	Significant
PV-> BI	1.121	0.000 <0.01	Significant
H-> BI	891	0.000 <0.01	Significant

Pearson Correlation Test

Pearson correlation test defines the extent to which the increase or decrease in the factors used in the model results in a change (increase or decrease) in the correlated dependent factor (Saunders et al., 2016). Thus, the results are represented in Table 7. Based on (Saunders et al., 2016), if value of Pearson Coefficient value is between (0-0.2) is very weak correlation, (0.2-0.4), (0.4-0.6) is a reasonable correlation; (0.6-0.8) is high correlation and finally (0.8-1) is very high correlation. Performance expectancy and Effort expectancy has a high correlation

value to the behavioral intentions to use University smart campus while, Social influence, Hedonic motivation and Price value have a very high correlation to the behavioral intention to use university smart campus.

Table 7: Person Correlation Test Results

Hypotheses	Pearson's correlation coefficient	P-value	Hypothesis accepted or rejected
H1(BI←PE)	0.621	p < 0.01	√
H2 (BI←EE)	0.674	p < 0.01	√
H3 (BI←SI)	0.881	p < 0.01	√
H4 (BI←FC)	0.731	p < 0.01	√
H5 (BI←HM)	0.913	p < 0.01	√
H6 (BI←PV)	0.837	p < 0.01	√
H7 (BI←H)	0.689	p < 0.01	√

5. Discussion of Results

This paper examines the intention behavioral of students to attend in a university with a smart campus. The results of the research are important for the following reasons. Firstly, the paper contributes theoretically to the usage of smart campus in education. Mainly, it focuses on Performance Expectancy, Effort Expectancy, Social influence, Facilitating Condition, Hedonic Motivation, price value and Habit. The research can emphasis researches in Egypt that focuses on smart campus, IOT in education and learning process.

Different previous researchers discussed the smart city and IOT usage in learning and education process. Results are in line with the previous researchers (Ionescu-Feleaga et al.,2021; Shaikh H. et al.,2019; Pérez et al.,2021 ; Mehta et al.,2019; Carcary, et al., 2018). Results of the analysis show that social influence, Hedonic Motivation and Price value have a very high correlation significant on student intention to use university smart campus. Performance Expectancy, Effort Expectancy, Facilitating condition and Habit have high correlation significance on the student intention to use university smart campus.

University students are going to enjoy using a smart campus, which is in line with the perspective of other literature. This motivates the students to use smart campuses. To add, the price of the services available to the students has a great focus to them.

6. Conclusion

This paper examined the factors affecting the usage of university smart campus. Academic researchers working in education and technology sectors can benefit from the results of this paper as it investigates the student behavior intention to use university smart campus.

The recommendation of this research is that educational institution should consider developing smart campuses in the university to enhance the learning process.

Practical Implication

This research provides important points in the education sector. The research model combined UTAUT factors and UTAUT 2, which are performance expectancy, effort expectancy, social influence, facilitating condition, hedonic motivation, price value and habit. Based on a sample of 321 university students, the findings revealed that they accept the usage of smart campus in university and they approve that smart campuses can enhance the learning process.

Limitation and Future work

Research limitation are summarized as follows. First, this research sample is limited to 321. A larger sample size is required to understand student perception to use university smart campus, and a comparative study should provide very interesting results such as testing the variables on European countries.

In addition, this study's results and model can be tested in Gulf countries that have experiences with smart campuses. Quantitative approach in the research is limited to the number of collecting data through an online questionnaire. Future research an adopt qualitative research such as interviews to provide more understanding of the intention of student to use smart campus.

Finally, the research did not examine how the demographic and culture dimensions affect student opinion to attend in university smart campus age,gender,education and income.

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